



**Total Maximum Daily Load (TMDL) for *Escherichia coli* (*E. coli*) for the
St. Joseph River, Elkhart and St. Joseph Counties**

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Indiana Department of Environmental Management
Total Maximum Daily Load Program
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**Total Maximum Daily Load (TMDL) for *Escherichia coli* (*E. coli*) in
St. Joseph River, St. Joseph and Elkhart Counties, Indiana**

Introduction

Section 303(d) of the federal Clean Water Act and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (Title 40 of the Code of Federal Regulations (CFR), Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not meeting Water Quality Standards (WQS). TMDLs provide states a basis for determining the pollutant reductions necessary from both point and nonpoint sources to restore and maintain the quality of their water resources. Both the Michigan Department of Environmental Quality (MDEQ) and the Indiana Department of Environmental Management (IDEM) have the St. Joseph River listed for *Escherichia coli* (*E. coli*) impairment on their respective 303(d) Lists of Impaired Waterbodies. MDEQ has the St. Joseph River listed from the Lake Michigan confluence in Morrison Channel upstream to Michigan/Indiana state line. IDEM has the St. Joseph River listed from the Michigan-Indiana State Line in Elkhart County to the Michigan-Indiana State Line in St. Joseph County. The MDEQ and IDEM have been working jointly to complete TMDLs on all listed segments of the St. Joseph River. The purpose of this TMDL is to identify the sources and determine the allowable levels of *E. coli* bacteria that will result in the attainment of the applicable WQS in St. Joseph River from the Michigan-Indiana state line in St. Joseph County to the Michigan-Indiana state line in Elkhart County.

Problem Statement

In 1998, Indiana's section 303(d) list cites the St. Joseph River as being impaired in Elkhart and St. Joseph River Counties. This TMDL address approximately 40 miles of St. Joseph River from the Michigan-Indiana State Line in Elkhart County to the Michigan-Indiana State Line in St. Joseph County where recreational uses are impaired by elevated levels of *E. coli* during recreational season. (Figure 1) The description of the study area, its topography and other particulars are as follows:

Waterbody:	St. Joseph River	303(d) #:	36
County:	Elkhart and St. Joseph Counties	Size:	40 miles
Basin:	Great Lakes	HUC:	04050001
Status: 2 Problem:	<i>E. coli</i> , Fish Consumption Advisory for PCB and mercury		

TMDL Schedule: 2000-2004, *E. coli*
2010-2012, Fish Consumption Advisory for PCB and mercury

Historical data collected by IDEM and the Interagency *E. coli* Task Force had documented elevated levels of *E. coli* in 1997 and these were the basis of the St. Joseph River being listed on the 1998 303(d) list. IDEM completed two intensive surveys of the St. Joseph River and its major tributaries between September 27, 2000 to October 26, 2000. Nineteen sites were sampled five times evenly spaced over a 30-day period during Indiana's recreation season of April 1 through October 31. Of the nineteen sites, fifteen sites violated the single day standard. Of the

fifteen sites that violated the single day standard, eight sites violated the geometric mean standard. Based on this intensive study in 2000, IDEM determined that a TMDL would need to be completed on the St. Joseph River. (Attachment A)

The Three Cities of Elkhart, Mishawaka, and South Bend (“the Three Cities”) had extensively sampled the St. Joseph River for *E. coli*. The results of their *E. coli* sampling completed in 2000 through 2003 are also included in developing this TMDL (Salee, M. 2003, Kopec, K. 2003, Zmudzinski, K. 2003). The *E. coli* results from the Three Cities have met the requirements of Indiana’s Quality Assurance Project Plan and were acceptable to be used in this TMDL. The Three Cities had sampled eighteen sites along the St. Joseph River. These eighteen sites were sampled during Indiana’s recreational and non-recreational seasons. Of the eighteen sites, twelve sites violated the single day standards during recreational season. Of the twelve sites that violated the single day standard, ten sites violated the geometric mean standard during recreational season.

The *E. coli* data collected by IDEM and the Three Cities showed similar results. Nine of IDEM’s nineteen sites sampled in 2000 were at the same locations as the Three Cities. (Figure 2 and Attachment A)

Water quality *E. coli* duration curves were created by combining both IDEM’s data and the data received from The Three Cities. A flow duration interval is defined as a percentage with zero (0) corresponding to the highest stream discharge (flood condition) to 100 corresponding to the lowest discharge (drought condition). The *E. coli* values at each site were plotted with the corresponding flow duration interval to show the *E. coli* violations of the single-day standard and geometric mean standard during both recreational and non-recreational season. (Attachment B)

Of the eighteen sites, sampled by The Three Cities, twelve of these sites were also sampled during non-recreational season. Of the twelve sites, eight of these sites would have violated either Indiana’s single-day or geometric mean *E. coli* standard during recreational season. However, Michigan does have a non-recreational season *E. coli* WQS from November 1 to April 30. Of the twenty-seven sites sampled in the St. Joseph River TMDL Watershed, seventeen sites were sampled during Michigan’s non-recreational season. Of these seventeen sites, six of these sites would have violated Michigan’s non-recreational season *E. coli* WQS.

Numeric Targets

The impaired designated use for the St. Joseph River at this location is for fullbody contact recreational use during the recreation season, April 1 through October 31.

327 IAC 2-1.5-8(e)(2), establishes the fullbody contact recreational use *E. coli* WQS¹ for all waters in the Great Lakes system as follows:

- (2) *E. coli* bacteria, using membrane filter (MF) count, shall not exceed one hundred twenty-five (125) per one hundred (100) milliliters as a geometric mean based on not less than five (5) samples equally spaced over a thirty (30) day period nor exceed two hundred thirty-five (235) per one hundred (100) milliliters in any one (1) sample in a thirty (30) day period.

The sanitary wastewater effluent limits from point sources in the Great Lakes system during the recreational season, April 1 through October 31, are also covered under 327 IAC 2-1.5-8(e)(2) for *E. coli* WQS.

¹ *E. coli* WQS = 125 cfu/100ml or 235 cfu/100ml; 1 cfu (colony forming units)= 1 mpn (most probable number)

Under Rule 100 of the Michigan WQS, the St. Joseph River must be protected for total body contact recreation from May 1 to October 31. The Michigan ambient *E. coli* standards are established in Rule 62 of the WQS as follows:

R 323.1062 Microorganisms.

Rule 62. (1) All waters of the state protected for total body contact recreation shall not contain more than 130 *Escherichia coli* (*E. coli*) per 100 ml, as a 30-day geometric mean. Compliance shall be based on the geometric mean of all individual samples taken during 5 or more sampling events representatively spread over a 30-day period. Each sampling event shall consist of 3 or more samples taken at representative locations within a defined sampling area. At no time shall the waters of the state protected for total body contact recreation contain more than a maximum of 300 *E. coli* per 100 ml. Compliance shall be based on the geometric mean of 3 or more samples taken during the same sampling event at representative locations within a defined sampling area.

Michigan does have a non-recreational, partial body contact, rule for *E. coli* that states in R 323.1062 that “all waters of the state protected for partial body contact recreation shall not contain more than a maximum of 1,000 *E. coli* per 100 milliliters. Compliance shall be based on the geometric mean of 3 or more samples, taken during the same sampling event, at representative locations within a defined sampling area.”

Under rule 327 IAC 5-2-11.3 (a), Indiana is responsible for not causing the pollution of a downstream water. 327 IAC 5-2-11.3 (a) states:

"For all waters within the Great Lakes system, the commissioner shall ensure that the level of water quality necessary to protect existing uses is maintained. In order to achieve this requirement, and consistent with 40 CFR 131.10, water quality standards use designations must include all existing uses. Controls shall be established as necessary on point and nonpoint sources of pollutants to ensure that the criteria applicable to the designated use are achieved in the water and that any designated use of a downstream water is protected. Where water quality does not support the designated uses of a waterbody or ambient pollutant concentrations are greater than water quality criteria applicable to that waterbody, the commissioner shall not allow a lowering of water quality for the pollutant or pollutants that prevents the attainment of such uses or the water quality criterion."

For the recreational season, May 1 to October 31, MDEQ has set the *E. coli* target level for their St. Joseph River TMDL at WQS of 130 per 100 ml as a 30-day geometric mean of five or more sampling events.

For the Indiana St. Joseph River TMDL, for the recreational season, April 1 through October 31, Indiana has set the target level at the *E. coli* WQS of 125 per one hundred milliliters as a 30-day geometric mean based on not less than five samples equally spaced over a thirty day period

Source Assessment

The St. Joseph River Watershed is located from the Michigan-Indiana State Line in Elkhart County to the Michigan-Indiana State Line in St. Joseph County. The 1998 303(d) Listed segment of the St. Joseph River is for Elkhart and St. Joseph Counties. (Figure 1) Based on sampling completed by IDEM and The Three Cities in 2000 through 2003, twenty-one of the twenty-seven sites exceeded WQS. Six of the sites that did not violate the *E. coli* WQS were located from the Indiana-Michigan State Line in Elkhart County to the city of Elkhart.

(Attachment B) Michigan does not have the upstream segment of the St. Joseph River entering Indiana as impaired by their WQS. It is recommended that this segment of the St. Joseph River be delisted from Indiana's 303(d) List of Impaired Waterbodies. This TMDL will therefore address the St. Joseph River from approximately Main Street at Elkhart downstream to the Indiana-Michigan State Line. (Figure 3)

The tributaries sampled include Little Elkhart River, Pine Creek, Christina Creek, Elkhart River, Baugo Creek, Eller Ditch, Willow Creek, and Juday Creek. The tributaries, Little Elkhart River, Pine Creek, and Christina Creek, that discharge into the St. Joseph River in the nonimpaired segment are not considered sources of the impairment. However, sampling completed on these three tributaries does show elevated levels of *E. coli* which will be addressed in separate TMDLs. The remaining tributaries are located in the impaired area. The data collected on the tributaries was compared to each respective downstream site on the St. Joseph River. When tributary data was above the *E. coli* WQS, so was the respective downstream site on the St. Joseph River. As when the tributary data was below the *E. coli* WQS, so was the respective site on the St. Joseph River. This concludes that the tributaries are contributing to the *E. coli* impairment in the St. Joseph River. (Attachment A and Figure 3)

Municipalities in this watershed include Granger, Georgetown, South Bend, Gulivoire Park, Mishawaka, Roseland, Indian Village, Osceola, Wapakoneta, Elkhart, Simonton Lake, Dunlap, Goshen, and Bristol. The landuse for this watershed is comprised of urban, agricultural, and forested. Urban and agricultural are the dominant landuse in this watershed. (Figure 4)

There is one Native American Tribe located in this watershed. It is the Pokagon Band of Potawatomie located in St. Joseph County. (Figure 5) According to 2000 Census data, there is no population associated with this Tribe at this location, so they are not considered to be a source of *E. coli* in the St. Joseph River.

There are 49 permitted discharges in the St. Joseph River TMDL Watershed. (Figure 6, Table 1) Twenty of permitted dischargers do not have *E. coli* limits in their permits. Thirteen discharges are groundwater, industrial, or manufactures. Seven of the permitted discharges have general permits, of which four are for groundwater petroleum remediation and the remaining three are for hydrostatic testing of commercial pipelines; sand, gravel, dimension stone, or crushed stone operations; and petroleum products. These twenty discharges do not contain a sanitary component to their discharge; therefore, these discharges are not contributing to the source of *E. coli* in the St. Joseph River and do not apply.

Nine of the permitted discharges have only total residual chlorine limits. These dischargers do have possible sanitary components in their discharge. Four of these discharges did report violations of their total residual chlorine limits during the 2000 through 2002. However, none of these nine dischargers had any enforcement actions taken on their total residual chlorine limits. Due to the complications of comparing total residual chlorine to *E. coli*, it is difficult to determine if any or to what extent these nine dischargers could be a source of *E. coli* in the St. Joseph River.

Four of the permitted discharges are for land application, production and use, and/or surface disposal. These permits are not suspected to be a source of the *E. coli* impairment in the St. Joseph River.

Three of the permitted discharges are for stormwater. Dairy Farmers of America (IN0055565) has a total residual chlorine limit, however the record states that there is no discharge. Metech International (INU059595) and Sunrise Orchards-Elkhart Co (IN0056855) does not have a

sanitary component to their stormwater. Since none of these discharges would be a source of *E. coli* to the St. Joseph River, they are not contributing to the *E. coli* impairment in the St. Joseph River.

Thirteen of the permitted discharges have *E. coli* limits. Two of these permits, Wakarusa Municipal STP (IN0024775) and Mishawaka Municipal STP (IN0025640), had *E. coli* violations in the years 2000- 2001, however no enforcement action was taken. These eleven permitted discharges are therefore meeting their *E. coli* limits and are not contributing to the *E. coli* impairment in the St. Joseph River.

Of the fourteen municipalities in the St. Joseph River Watershed, five have combined sewer overflows (CSO). The number of CSOs per city are broken down as follows: Elkhart has 22 CSO outfalls, Mishawaka has 19 CSO outfalls, South Bend has 35 CSO outfalls, Goshen has 6 CSO outfalls, and Wakarusa has 6 CSO outfalls. Currently CSO Long Term Control Plans (LTCP) have been developed and are at IDEM and EPA for review for Elkhart and Mishawaka. South Bend's CSO LTCP is not due until December of 2005, while Goshen's and Wakarusa's LTCPs are due in December of 2004. The CSOs are considered a source of *E. coli* to the St. Joseph River Watershed.

Based on the non-recreational season data received from The Three Cities, it can be concluded that *E. coli* data collected during Indiana's non-recreational season would exceed the WQS for *E. coli* during recreational season. Since Michigan has the St. Joseph River impaired at the state line downstream to Lake Michigan, it can be concluded that Indiana is contributing to the *E. coli* violations per Michigan's recreational *E. coli* WQS.

Linkage Analysis and *E. coli* Load Duration Curves

The link between the *E. coli* concentrations in the St. Joseph River and the potential sources are the basis for the development of the TMDL. The linkage is defined as the cause and effect relationship between the selected indicators and the sources. This provides the basis for estimating the total assimilative capacity of the stream and any needed load reductions. A significant amount of the *E. coli* load for this TMDL likely enters the St. Joseph River by both wet and dry weather sources.

To further investigate the potential sources mentioned above, as outlined in an unpublished paper by Cleland (2002), an *E. coli* load duration curve analysis was developed for each sampling station on the St. Joseph River. A load duration curve is a relatively new method utilized in TMDL development and considers how stream flow conditions relate to a variety of pollutant loadings and their sources (point and non-point sources).

In order to develop a load duration curve, continuous flow data is required. The USGS gage (4101500) located in Niles, Michigan, was used for the development of the *E. coli* load duration curve analysis for the Michigan portion of the St. Joseph River TMDL. The Indiana portion of the St. Joseph River TMDL used the USGS gage (04101000) located in Elkhart, Indiana for the development of the load duration curve analysis. Based on a comparison completed on these two gages, it is concluded that they are similar and could be used to create the load duration curves in each state.

The flow data is used to create flow duration curves, which display the cumulative frequency of distribution of the daily flow for the period of record. The flow duration curve relates flow values measured at the monitoring station to the percent of time that those values are met or exceeded.

Flows are ranked from extremely low flows, which are exceeded nearly 100 percent of the time, to extremely high flows, which are rarely exceeded. Flow duration curves are then transformed into load duration curves by multiplying the flow values along the curve by applicable water quality criteria values for *E. coli* and appropriate conversion factors. The load duration curves are conceptually similar to the flow duration curves, in that the x-axis represents the flow recurrence interval and the y-axis represents the allowable load of the water quality parameter. The curve representing the allowable load of *E. coli* was calculated using the daily and geometric mean standards of 235 *E. coli* per 100 ml and 125 *E. coli* per 100 ml, respectively. The final step in the development of a load duration curve is to add the water quality pollutant data to the curves. Pollutant loads are estimated from the data as the product of the pollutant concentrations, instantaneous flows measured at the time of sample collection, and appropriate conversion factors. In order to identify the plotting position of each calculated load, the recurrence interval of each instantaneous flow measurement was defined. Water quality pollutant monitoring data are plotted on the same graph as the load duration curve which provides a graphical display of the water quality conditions in the waterbody. The pollutant monitoring data points that are above the target line exceed the WQS; those that fall below the target line meet WQS (Mississippi DEQ, 2002).

The load duration curves for each station sampled on the St. Joseph River are included in Attachment C. The load duration curves created for the sampling sites on the St. Joseph River that have continuous monitoring from 2000 through 2003 best describe the sources of *E. coli* to the St. Joseph River. These sampling sites are Bittersweet, Angela, Colfax, Ironwood, Auten Rd., Main St. (Mishawaka). The data indicate that while the largest exceedances of the *E. coli* WQS are prevalent during wet weather events (noted by diamonds above the curve on the far left side of the figure), dry weather contributions are also a source of *E. coli* to the St. Joseph River (noted by the diamonds above the curve on far right side of the figure). This is further supported by a similar analysis of data collected by MDEQ (Michigan Department of Environmental Quality, 2003).

The guiding water quality management principle was used to develop the St. Joseph River TMDL. Compliance with the numeric *E. coli* WQS target in the St. Joseph River depends on the success of the CSO LTCP, requiring permitted discharges with total residual chlorine limits to monitor for *E. coli*, requiring permitted discharges to monitor for *E. coli* during non-recreational season, and controlling of nonpoint sources using best management plans (BMPs). If the *E. coli* inputs can be controlled as outlined in this paragraph, then full body contact recreation use in St. Joseph River will be protected.

TMDL Development

The TMDL represents the maximum loading that can be assimilated by the waterbody while still achieving WQS. As indicated in the Numeric Targets section, the target for this *E. coli* TMDL is 125 per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over a thirty day period from April 1 through October 31. Concurrent with the selection of a numeric concentration endpoint, TMDL development also defines the environmental conditions that will be used when defining allowable levels. Many TMDLs are designed as the set of environmental conditions that, if controls are designed and put in place, will ensure attainment of WQS for the pollutants. For example, the critical conditions for the control of point sources in Indiana are given in 327 IAC 5-2-11.1(b). In general, the 7-day average low flow in 10 years (Q7,10) for a stream is used as the design condition for point source discharges. However, *E. coli* sources to St. Joseph River arise from a mixture of dry and wet weather-driven conditions, and there is no single critical condition that would achieve the *E. coli* WQS. For the

St. Joseph River and the contributing sources, there could be a number of different allowable loads that will ensure compliance, as long as they are distributed properly throughout the watershed.

For most pollutants, TMDLs are expressed on a mass loading basis (e.g. pounds per day). For *E. coli* indicators, however, mass is not an appropriate measure, and the USEPA allows *E. coli* TMDLs to be expressed in terms of organism counts (or resulting concentration) (USEPA, 2001). Therefore, this *E. coli* TMDL is concentration-based consistent with 327 IAC 5-2-11.1(b) and 40 CFR, Section 130.2 (i) and the TMDL is equal to the *E. coli* WQS for a geometric mean for each month of the recreational season (April 1 through October 31).

Allocations

TMDLs are comprised of the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include a Margin of Safety (MOS), either implicitly or explicitly, that accounts for uncertainty in the relation between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation:

$$\text{TMDL} = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS}$$

The term TMDL represents the maximum loading that can be assimilated by the receiving water while still achieving WQS. The overall loading capacity is subsequently allocated into the TMDL components of WLAs for point sources, LAs for nonpoint sources, and the MOS. As previously indicated, this *E. coli* TMDL is not expressed on a mass loading basis but is concentration-based consistent with USEPA regulations at 40 CFR, Section 130.2(i).

WLAs

As mentioned previously, there are 49 permitted point source discharges to the St. Joseph River or its tributaries. Twenty discharges are covered by either general permits or individual permits that do not have a sanitary component to their discharge. Thirteen permits do have *E. coli* limits, but are not violating their *E. coli* limits on a consistent basis. Nine discharges have total residual chlorine limits, but they are not violating their limits on a consistent basis. Three stormwater permits are in the watershed, but they are not recording a discharge. The four land application permits do not show any discharge locations or limits. These 49 discharges are not considered sources of *E. coli* to the St. Joseph River.

There are 88 CSOs located in the St. Joseph River that are considered a source of *E. coli*. The *E. coli* levels in the St. Joseph River are significantly higher after a rainfall. The 88 CSOs are broken down as follows: The City of Elkhart has twenty-two CSOs, the City of Mishawaka has nineteen CSOs, the City of South Bend has 35 CSOs, the City of Goshen has six CSOs, and the City of Wakarusa has six CSOs. As was mentioned in the Source Assessment Section CSO LTCPs are being developed for each of these CSO communities. Currently the Three Cities of Mishawaka and Elkhart have submitted CSO LTCPs. Goshen's and Wakarusa's LTCPs are due in December of 2004, while South Bend's CSO LTCP is not due until December of 2005. The goal of the CSO LTCP is for the CSO's to meet Indiana's WQS at time of discharge into their receiving stream. Each CSO LTCP must be approved by IDEM and U.S. EPA. Since the CSOs are considered a source of *E. coli* and at time of discharge the CSO must meet Indiana's WQS, the WLA is set at the WQS of 125 per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over a thirty day period.

Since, the St. Joseph River flows into Michigan, where it is also impaired, Indiana is a source of *E. coli* to the St. Joseph River in Michigan. The load duration curves not only show exceedances of the WQS during Indiana's recreational season but during non-recreational season. Since Michigan has a partial body contact rule and Indiana is not to cause impairments of a downstream waterbody as stated in 327 IAC 5-2-11.3 (a), the WLA may be adjusted to WQS permit limits for the non-recreational season.

LAs

This TMDL is concentration-based; therefore, the LA is equal to WQS of 125 per one hundred milliliters as a geometric mean based on not less than five samples equally spaced over a thirty day from April 1 through October 31. The assumption used in the allocation strategy is that there are equal bacteria loads per unit area for all lands within the watershed. Therefore, the relative responsibility for achieving the necessary reductions of bacteria and maintaining acceptable conditions will be determined by the amount of land under the jurisdiction of the various local units of government within the watershed. This gives a clear indication of the relative amount of effort that will be required by each entity to restore and maintain the total body contact designated uses to St. Joseph River.

The government entities with the largest percent land area in the St. Joseph River TMDL watershed are the Penn Township (12.3%), City of South Bend (9.4%), Harrison Township (8.5%), City of Granger (6.9%), and Clinton Township (6.2%). The second largest percentage consists of the Three Cities and townships have 3 to 4 percent of the land area. This group consists of the remaining two large cities, Mishawaka and Elkhart, and the townships with the larger area. The remaining percentages of 2% and lower consist of the smaller cities and those parts of the townships that are not included in the larger cities or where only portions of the townships are included in the watershed (ESRI). (Table 2 and Figure 5 and 7)

Margin of Safety (MOS)

This section addresses the incorporation of a MOS in the TMDL analysis. The MOS accounts for any uncertainty or lack of knowledge concerning the relationship between pollutant loading and water quality. The MOS can be either implicit (i.e., incorporated into TMDL analysis thorough conservative assumptions) or explicit (i.e., expressed in the TMDL as a portion of the loadings). This TMDL uses an implicit MOS because no rate of decay is used. IDEM has determined that the use of the *E. coli* WQS of 125 per one hundred milliliters is a more conservative approach, although *E. coli* bacteria have a limited capability of surviving outside of their hosts and a rate of decay would normally be used. Applying a rate of decay could result in a discharge limit that would be greater than the *E. coli* WQS, thus no rate of decay is applied in order to provide for a greater protection of water quality. Applying the *E. coli* WQS to be met under all flow conditions also adds to the assurance of the MOS.

Seasonality

Seasonality in the TMDL is addressed by expressing the TMDL in terms of a total body contact recreation season that is defined as April 1 through October 31 by Indiana Rule 327 IAC 2-1.5-8(e)(2) for the *E. coli* WQS. There is no total body contact during the remainder of the year in Indiana. In addition, because this is a concentration-based TMDL, *E. coli* WQS will be met regardless of flow conditions in the applicable season.

Monitoring

Future monitoring will take place during the 5-year rotating basin schedule and/or once implementation methods are in place. During the 5-year rotating basin schedule, the St. Joseph River Watershed will be monitored at a minimum for 5 consecutive weeks between April 1 through October 31. Sampling will be adjusted as needed to assist in continued source identification and elimination. When these results indicate that the waterbody is meeting *E. coli* WQS, sampling will be conducted at the appropriate frequency to determine if the 30-day geometric mean value of 125 *E. coli* per one hundred milliliters is being met. Once the data has been collected and reviewed, the information will be passed to MDEQ for their information.

In addition to IDEM collecting data in 2000, the Three Cities collect data each year. For this TMDL, IDEM only used the *E. coli* data that was collected between 2000 through 2003. After IDEM will request The Three Cities' *E. coli* data for each year additional monitor by IDEM is completed. The Three Cities' data will be used to assist in determining if the St. Joseph River is meeting *E. coli* WQS.

Hoosier Riverwater Group collects water quality data at sites along the St. Joseph River and its major tributaries. The data collected by this group is fecal data. This information is used as background data and has not been directly applied to this TMDL.

MDEQ monitored in 2002 and plans on completing future sampling of the St. Joseph River during their rotating, 5-year basin monitoring schedule. Once the results indicate that the waterbody may be meeting *E. coli* WQS, MDEQ will conduct sampling at appropriate frequency to determine if the 30-day geometric mean value of 130 *E. coli* per 100 milliliters is being met.

Reasonable Assurance Activities

The permitted discharges only have to monitor for *E. coli* during recreational season, April 1 through October 31. Data collected for this TMDL during non-recreational season shows *E. coli* values well above the *E. coli* WQS. Michigan does have an *E. coli* value that must be met during their non-recreational season. To assist with the St. Joseph River meeting standards in Michigan and Indiana during their recreational and non-recreational seasons, IDEM will propose that during their next permit renewal to require year round *E. coli* limits. This will be in accordance with Indiana rule 327 IAC 5-2-11.3 (a). For the permitted discharges that have only total residual chlorine limits, IDEM proposes that during their next permit renewal to add *E. coli* limits and monitoring.

As was previously stated, the goal of the LTCPs is for the CSOs to meet WQS standards. These plans must be approved by IDEM and U.S. EPA before they are considered final. All the LTCPs for the effected cities in this TMDL should be approved by early 2006. These LTCPs will assist the St. Joseph River in meeting the *E. coli* WQS during wet weather events.

There have been multiple watershed projects that have been completed or are ongoing in the St. Joseph River Watershed. Four watershed projects, from 1991 through 2000, have been completed on Juday Creek. The project in 1991 was sponsored by the St. Joseph River Basin Commission to create a watershed management plan. The project in 1995, sponsored by Michiana Area Council of Governments (MACOG), was to encourage riparian landowners to install BMPs. The project in 1998, sponsored by the St. Joseph County Drainage Board, created a cost-share program to reduce erosion and sedimentation. The last project in 2000, sponsored by the St. Joseph County Drainage Board, was to work with bank stabilization.

An education project for Eller Creek was funded in 1997 to address erosion controls and education the public.

The Elkhart County Commissioners sponsored a project for water quality monitoring and engineering to prioritize watersheds in Elkhart County according to their levels of *E. coli*. Based on the findings, the watershed with the highest level of *E. coli* will have a watershed management plan developed.

MACOG also sponsored a project to develop a watershed management plan on Baugo Creek. This included creating a database of land use and potential water quality impairments for Baugo Creek and sub-watersheds.

There have been two watershed projects that effected the entire St. Joseph River Basin. One of the projects, started in 2001, was an education project implemented by MACOG to educate builders and developers on landuse changes and impacts on nonpoint source pollution throughout the St. Joseph River Basin. This project also created a video to stress the care and maintenance of on-site sewage disposal systems. The second project was sponsored by the City of Elkhart to establish a watershed protection initiative between Elkhart, Mishawaka, and South Bend for the St. Joseph River for *E. coli*. This project includes water quality monitoring and then developing of a water quality model to characterize point and nonpoint sources of *E. coli*.

IDEM's Fixed Station *E. coli* data was collected until 2000. When the fixed station data was compared with the data used in completing the TMDL, an improvement in the *E. coli* values for the St. Joseph River was evident. This shows the benefits of these watershed projects and other efforts in the St. Joseph Basin to improve the water quality of the St. Joseph River. The completed and current watershed projects will continue to assist in identifying and reducing the nonpoint sources of *E. coli* in the St. Joseph River

E. coli TMDLs are scheduled for six of the tributaries on the St. Joseph River. The following table shows when these six tributary TMDLs will be completed.

303(d) #	Stream Name	County	Scheduled TMDL
7	Elkhart River	Elkhart and Noble	2015-2020
14	Juday Creek	St. Joseph	2015-2020
232	Baugo Creek	Elkhart	2010-2015
236	Little Elkhart River	Elkhart and St. Joseph	2015-2020
237	Willow Creek	St. Joseph	2015-2020
250	Pine Creek	LaPorte and St. Joseph	2014-2019

The TMDL will help to point out sources of *E. coli* on these tributaries, which will help to improve the water quality of the St. Joseph River.

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REFERENCES

- Cleland, B. 2002 TMDL Development from the “Bottom Up”-Part II. Using Duration Curves to Connect the Pieces. America’s Clean Water Foundation.
- ESRI. May 2003. <http://www.esri.com/data/download/census2000_tigerline>.
- Indiana Department of Environmental Management (IDEM), 1998. Indiana 1998 303(d) List of Impaired Waterbodies for Total Maximum Daily Load (TMDL) Development.
- Kopec, K. Personal Communication. City of Mishawaka. February 2003.
- Michigan Department of Environmental Quality (MDEQ). 2003. Draft St. Joseph River TMDL.
- Mississippi Department of Environmental Quality. 2002. Fecal Coliform TMDL for the Big Sunflower River, Yazoo River Basin.
- Salee, M. Personal Communication. City of Elkhart. February 2003.
- USEPA. 2001. Protocol for Developing Pathogen TMDLs. United States Environmental Protection Agency, 841-R-00-002.
- Zmudzinski, K. Personal Communciation. City of South Bend. February 2003.

Table 1: Permitted Discharges in St. Joseph River TMDL Watershed

Permitted Discharges with E.coli Limits

<u>Permit No.</u>	<u>Facility Name</u>	<u>Receiving Waters</u>
IN0025674	Elkhart WWTP	St. Joseph River
	CSO- Cassopolis/Beardsley	St. Joseph River
	CSO-Johnson/Beardsley	St. Joseph River
	CSO-Michigan/Fulton	St. Joseph River
	CSO-W.Boulevard/McNaughton	St. Joseph River
	CSO-McNaughton Park West	St. Joseph River
	CSO-Michigan at RVR, S. of Lex.	St. Joseph River
	CSO-Bridge and Hudson	St. Joseph River
	CSO-S.Shore/Cottage Court	St. Joseph River
	CSO-S.Shore/Nadel	St. Joseph River
	CSO-Franklin/8 th	St. Joseph River
	CSO-Indiana/Franklin	St. Joseph River
	CSO-Pottawatomie/Second	St. Joseph River
	CSO-Main/Pottawatomie	St. Joseph River
	CSO-Edgewater/Navajo	St. Joseph River
	CSO-Washington at River	St. Joseph River
	CSO-Jefferson at the River	St. Joseph River
	CSO-Edgewater/Okema	St. Joseph River
	CSO-Lexington/6 th	St. Joseph River
	CSO-Franklin/Krau	St. Joseph River
	CSO-West High at River	St. Joseph River
	CSO-McNaughton Park South	St. Joseph River
	CSO-Nappanee/Lexington	St. Joseph River
INL025674	Elkhart WWTP	
	Land Application	
	Production and Use	
IN0025640	Surface Disposal	
	Mishawaka Municipal STP	St. Joseph River
	CSO-Middleboro Street	St. Joseph River
	CSO-Logan Street	St. Joseph River
	CSO-Calhoun Street	St. Joseph River
	CSO-Webster Street	St. Joseph River
	CSO-Clay Street	St. Joseph River
	CSO-Benton Street	St. Joseph River
	CSO-Charlotte Street	St. Joseph River
	CSO-West Street	St. Joseph River
	CSO-ChristyAnn Street	St. Joseph River
	CSO-Cedar Street	St. Joseph River
	CSO-Laurel Street	St. Joseph River
	CSO-Merrifield Park Boat Land	St. Joseph River
	CSO-Merrifield Park West	St. Joseph River
	CSO-Battell Street	St. Joseph River
	CSO-Roosevelt Avenue	St. Joseph River
	CSO-Main Street	St. Joseph River
	CSO-Plant Outfall East	St. Joseph River
	CSO-Vistula Rd at Ballard Ave	St. Joseph River
	CSO-Lincolnway, E. Cedar Overflow	St. Joseph River

Permitted Discharges with E.coli Limits (continued)

Permit No.	Facility Name	Receiving Waters
INL025640	Mishawaka Municipal STP Land Application Production and Use	
IN0024520	South Bend Municipal STP	St. Joseph River
INM024520	City of South Bend	
	CSO-Oakwood Blvd/Riverside Dr.	St. Joseph River
	CSO-Sherman/Riverside Dr.	St. Joseph River
	CSO-Sherman/McCartney	St. Joseph River
	CSO-West End Angela Bridge	St. Joseph River
	CSO-Riverside/LeLand Ave.	St. Joseph River
	CSO-Lafayette St./Park Lane	St. Joseph River
	CSO-Park Lane/Main St.	St. Joseph River
	CSO-Bartlett St./Riverside Dr.	St. Joseph River
	CSO-LaSalle/Michigan	St. Joseph River
	CSO-LaSalle/Michigan	St. Joseph River
	CSO-Monroe/Lincolnway East	St. Joseph River
	CSO-Bowman Creek	St. Joseph River
	CSO-Miami/Lincolnway East	St. Joseph River
	CSO-Lincolnway/Twyckenham	St. Joseph River
	CSO-East End Trunk Sewer	St. Joseph River
	CSO-Lafayette/North Shore	St. Joseph River
	CSO-Leeper Ave.	St. Joseph River
	CSO-Niles/Sorin	St. Joseph River
	CSO-Niles/Sorin	St. Joseph River
	CSO-Colfax/Sycamore	St. Joseph River
	CSO-St. Louis/North Side	St. Joseph River
	CSO-Cooper Bridge	St. Joseph River
	CSO-Emerson/North Side Blvd.	St. Joseph River
	CSO-Clover St./North Side Blvd.	St. Joseph River
	CSO-Twyckenham/North Side Blvd.	St. Joseph River
	CSO-21 st /Pleasant St.	St. Joseph River
	CSO-North Side Blvd./26 th St.	St. Joseph River
	CSO-27 th Street Lift Station	St. Joseph River
	CSO-Alley-31-32-North Side Blvd.	St. Joseph River
	CSO-North Side Blvd./36 th Street	St. Joseph River
	CSO-North Side Blvd./Logan	St. Joseph River
	CSO-Northview/Riverside	St. Joseph River
	CSO-Main Plant CSO	St. Joseph River
	CSO-Siphon River Crossing #1 (Playland Park)	St. Joseph River
	CSO-Siphon River Crossing #2 (Sample Street)	St. Joseph River
INL025640	South Bend Municipal STP Land Application Production and Use	
IN0038989	Broadmore Estates (Three Oaks)	Pine Creek
IN0025755	Goshen Municipal STP	Elkhart River
	CSO-Riverside Boulevard	Elkhart River
	CSO-Indiana Avenue	Elkhart River
	CSO-Wilkinson Street	Elkhart River
	CSO-Purl Street	Elkhart River
	CSO-Plymouth Avenue	Elkhart River
	CSO-WWTP Headworks	Elkhart River

Permitted Discharges with E.coli Limits (continued)

<u>Permit No.</u>	<u>Facility Name</u>	<u>Receiving Waters</u>
INM025755	Goshen Combined Sewer System	
INL025755	Goshen Municipal STP Land Application	
	Production and Use	
IN0022845	Jimtown Elementary and High School	Baugo Creek
IN0023761	Middlebury Municipal STP	Little Elkhart River
IN0050717	Norfolk Southern Corp, Elkhart	
IN0033065	Timberbrook Mobile Home Park	Sheep Creek
IN0024775	Wakarusa Municipal STP	Werntz Ditch
	CSO-N. Washington Street	Werntz Ditch
	CSO-North Olive Street	Werntz Ditch
	CSO-Sycamore Street/Olive Street	Werntz Ditch
	CSO-Elkhart Street/Sycamore Street	Werntz Ditch
	CSO-North Spring Street	Werntz Ditch
	CSO-Indiana Street/Waterford Street	Werntz Ditch
IN0000884	Plume De Veau Plant	Auten Ditch

Permitted outfalls with residual chlorine limits

<u>Permit No.</u>	<u>Facility Name</u>	<u>Receiving Waters</u>
IN0036846	Bristol Municipal STP	St. Joseph River
IN0000884	Berliner & Marx/Plume de Veau	Auten Ditch
IN0037761	Clear Water Mobile Home Village	Auten Ditch
IN0036781	Fairfield Jr-Sr High School	Hydraulic Canal
IN0000761	Johnson Controls, Inc.	Rock Run Creek
IN0040363	Millersburg Municipal STP	Stoney Creek
IN0041602	Sunset Trailer Village	Auten Ditch
IN0059242	Timberbrook Mobile Home Community	Sheep Creek
IN0030848	Virgil Grissom Middle School	Rogers Ditch

General Permits no E.coli

<u>Permit No.</u>	<u>Facility Name</u>	<u>Receiving Waters</u>
ING080103	Henschen Oil, Inc	
ING080059	Toll Road Service Area 5 North	
ING080056	Marathon Gasoline Station	
ING340054	South Bend Terminal	
ING670029	South Bend Terminal	
ING080120	7-Eleven, Inc Store #32578	
ING490082	Aggregate Industries dba as Fidler Inc	

Permits with No E.coli or residual chlorine limits

<u>Permit No.</u>	<u>Facility Name</u>	<u>Receiving Waters</u>
<u>Individual NPDES Permits</u>		
IN0000493	Bechtel Plant Machinery, Inc	no discharge
IN0055468	Juday Creek Estates Subdivision	Juday Creek
IN0051080	Bristolpipe Corporation	Little Elkhart River
IN0000345	Mishawaka Utilities Water Dept.	no discharge
IN0000922	Holy Cross Services Corporation	St. Joseph River

Permits with No E.coli or residual chlorine limits (continued)

<u>Permit No.</u>	<u>Facility Name</u>	<u>Receiving Waters</u>
IN0056707	Bayer Corporation	St. Joseph River
INU059455	Amoco Oil Company-Bulk Terminal	on-site infiltration basin
IN0050717	Norfolk Southern Corporation	Crawford Ditch
IN0052400	Syndicate Store Fixture	Mathers Ditch
IN0022845	Baugo Community Schools	Baugo Creek
IN0059820	CMI-Precision Mold, Inc	unnamed tributary to York Township Ditch
IN0061409	Central Rubber & Plastics, Inc.	Rock Run Creek
IN0049875	Bodine State Fish Hatchery	St. Joseph River

No E.coli limits and stormwater permit

<u>Permit No.</u>	<u>Facility Name</u>	<u>Receiving Waters</u>
IN0056855	Sunrise Orchards-Elkhart Co.	Elkhart River

Stormwater permits

<u>Permit No.</u>	<u>Facility Name</u>	<u>Receiving Waters</u>
IN0055565	Dairy Farmers of America	
INU059595	Metech International	

Table 2: Land Area Distribution for the St. Joseph River TMDL Watershed

Municipality	Square Mile	Percent
Penn Township	46.77	12.3
City of South Bend	35.76	9.4
Harrison Township	32.21	8.5
City of Granger	26.2	6.9
Clinton Township	23.6	6.2
Madison Township	18.1	4.8
Concord Township	16.6	4.4
Elkhart Township	16.89	4.4
Olive Township	16.46	4.3
City of Elkhart	16.01	4.2
City of Mishawaka	16.03	4.2
Baugo Township	14.77	3.9
Cleveland Township	13.36	3.5
City of Goshen	12.78	3.3
Centre Township	11.63	3.1
Clay Township	9.0	2.4
German Township	8.14	2.1
Union Township	7.69	2.0
Jefferson Township	7.0	1.8
Middlebury Township	4.9	1.3
City of Dunlap	4.23	1.1
Locke Township	4.09	1.1
Osolo Township	3.66	1.0
City of Roseland	0.39	0.19
Portage Township	3.6	0.9
City of Wakarusa	2.26	0.6
City of Georgetown	1.95	0.5
City of Osceola	1.37	0.4
City of Gulivoire Park	1.37	0.4
Warren Township	1.0	0.3
Greene Township	1.0	0.3
City of Indian Village	0.1	0.02
Benton Township	0.8	0.2
Total	379.72	100

Figure 1: St. Joseph River TMDL Watershed

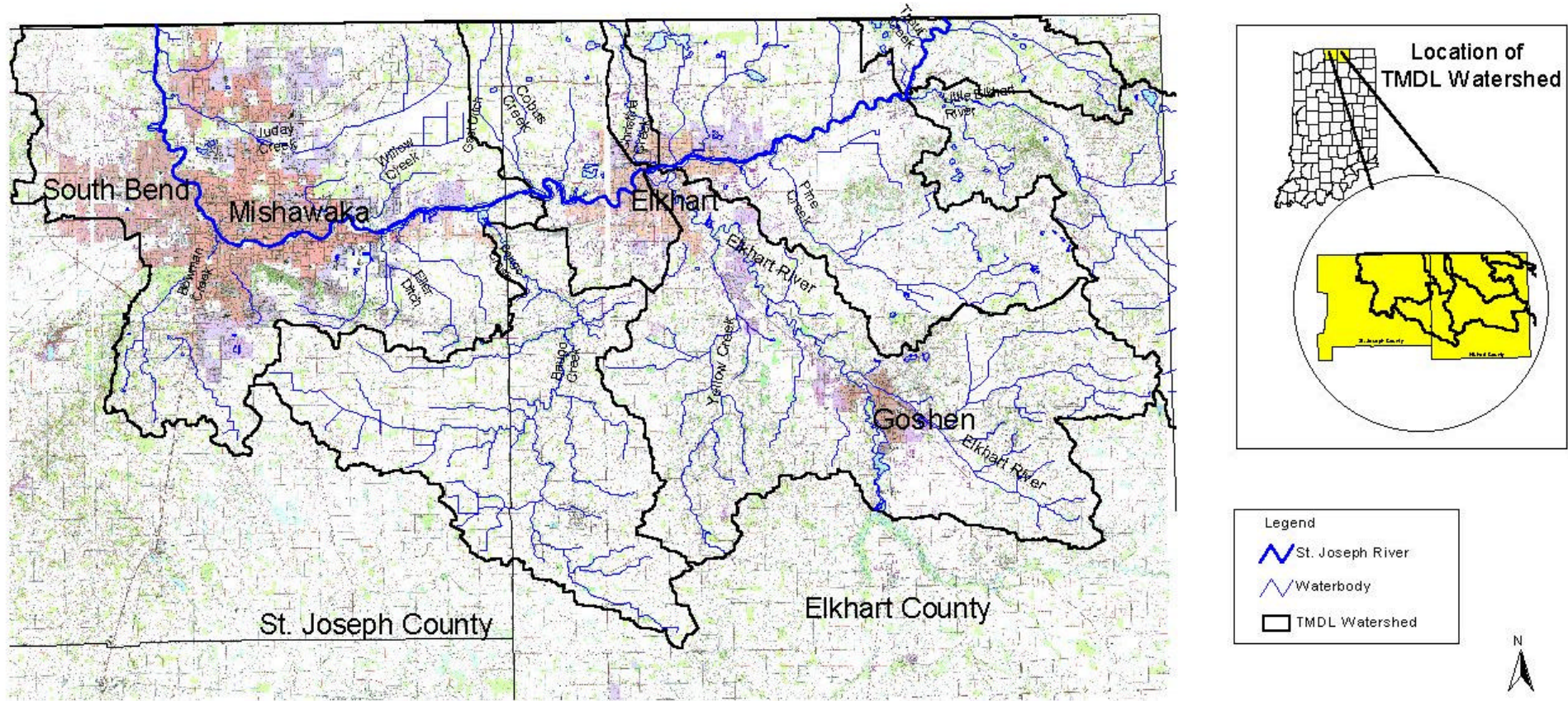


Figure 2: St. Joseph River Sampling Sites

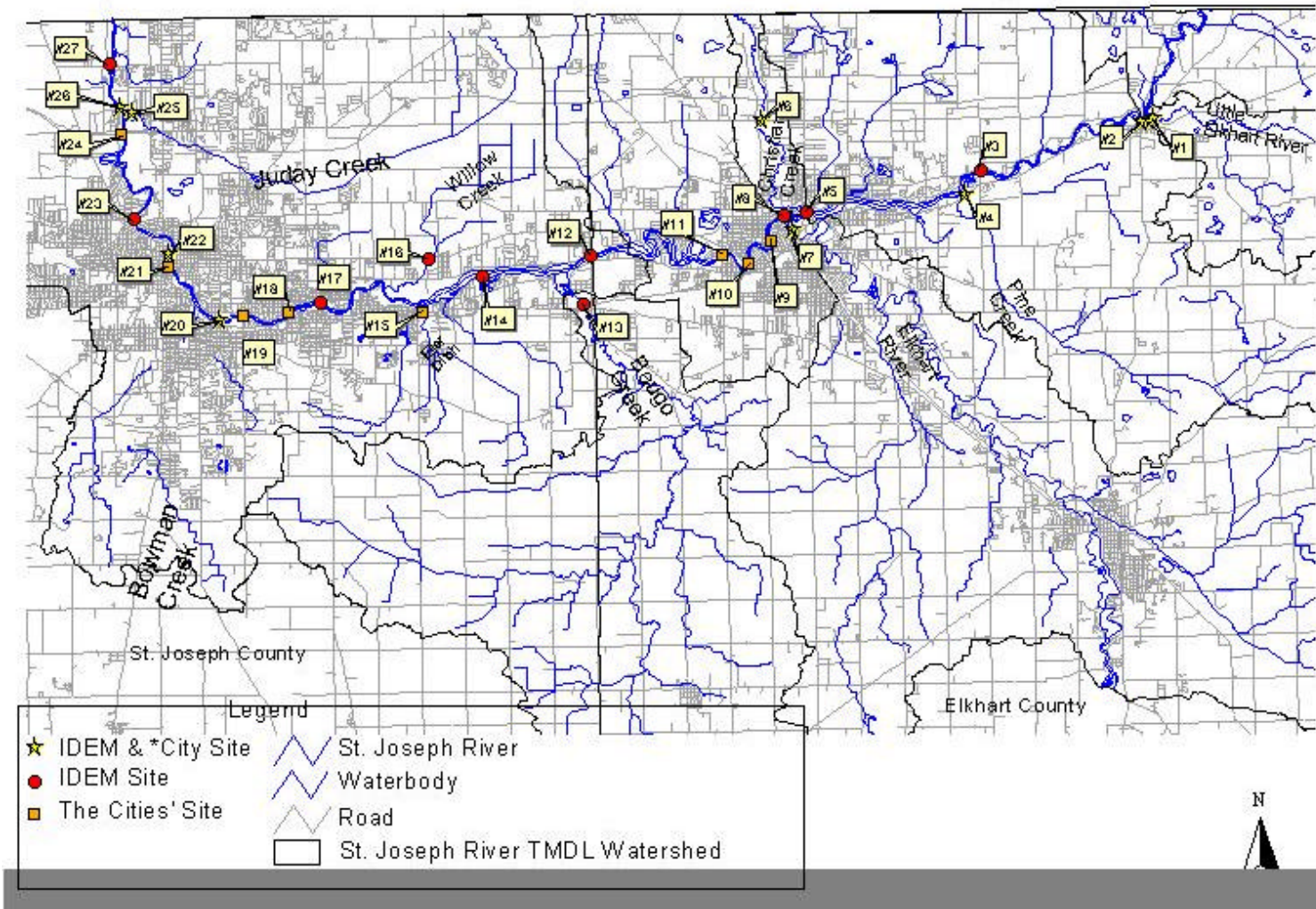


Figure 3: St. Joseph River TMDL Impaired Reach

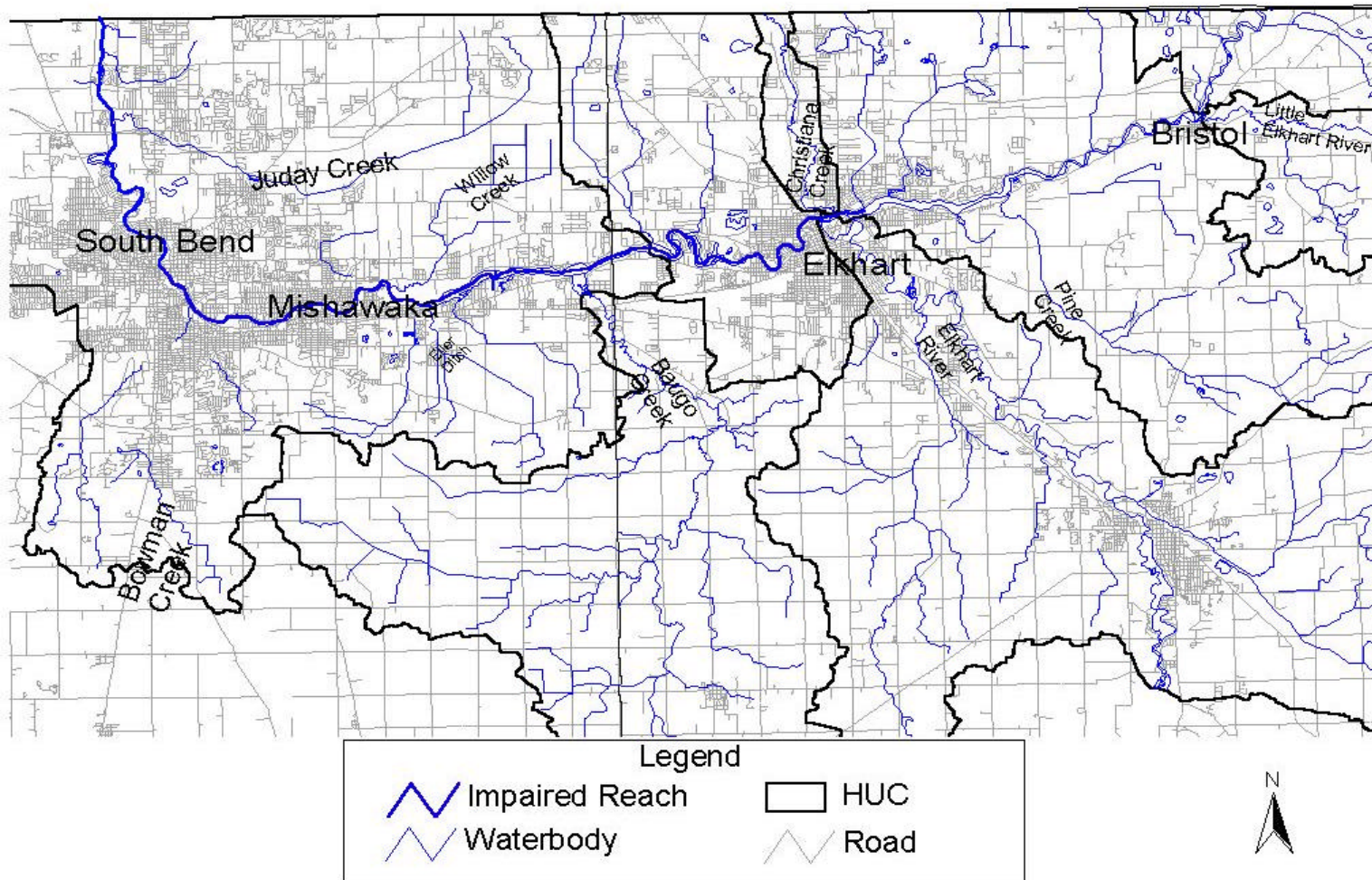


Figure 4: Landuse for the St. Joseph River TMDL Watershed

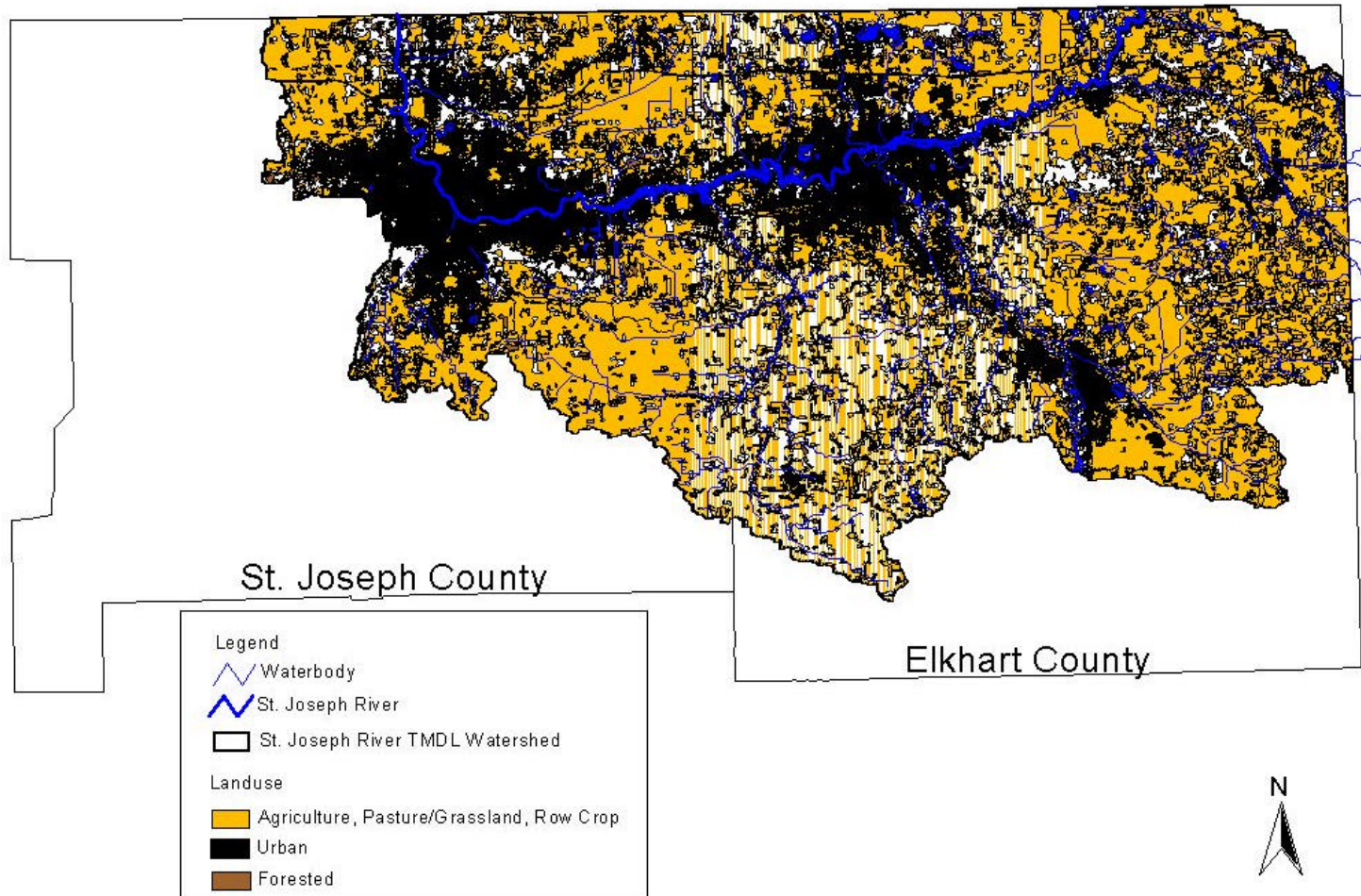


Figure 5: Municipalities in St. Joseph River TMDL Watershed

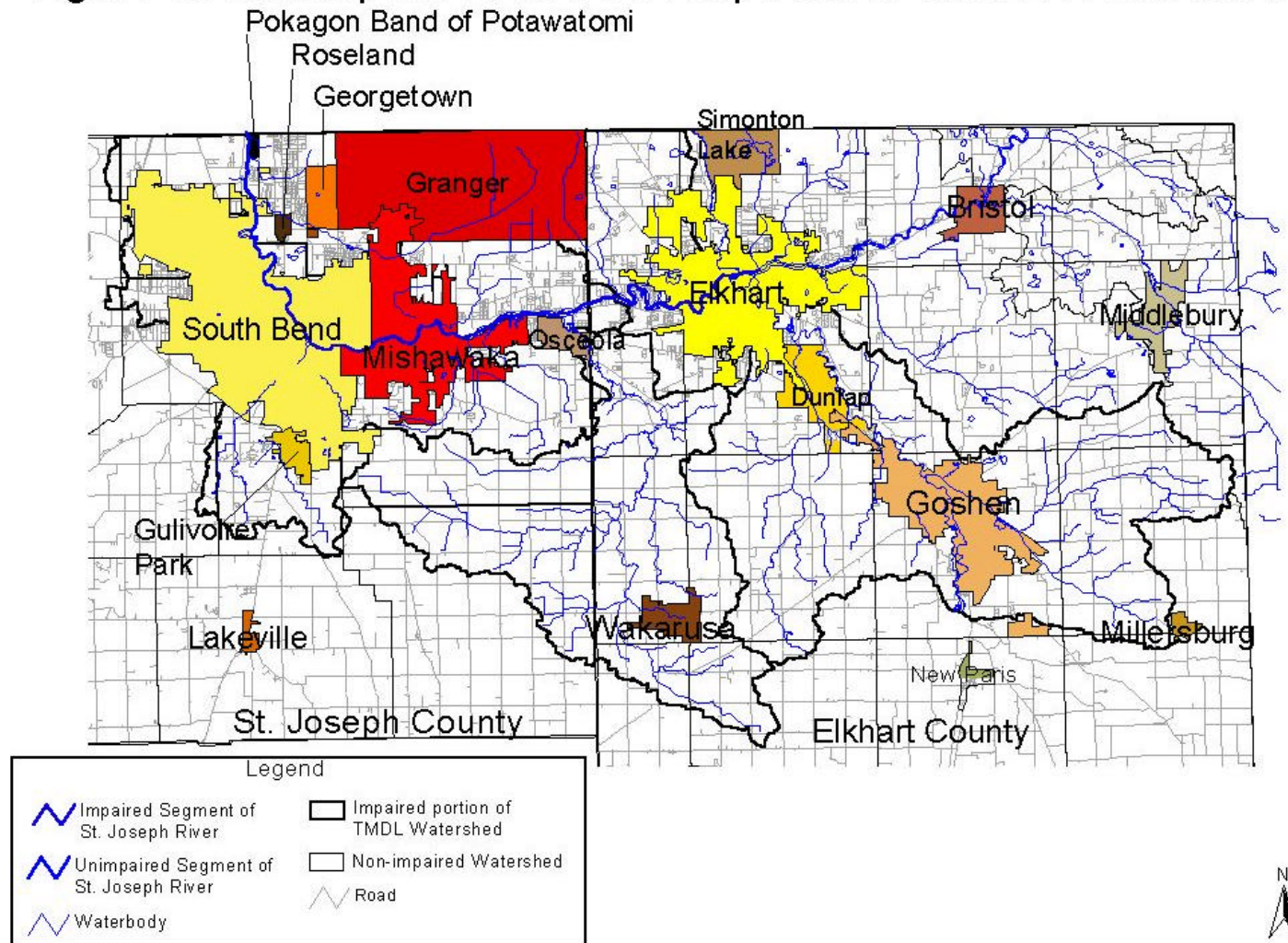


Figure 6: Permitted Discharges in St. Joseph River TMDL Watershed

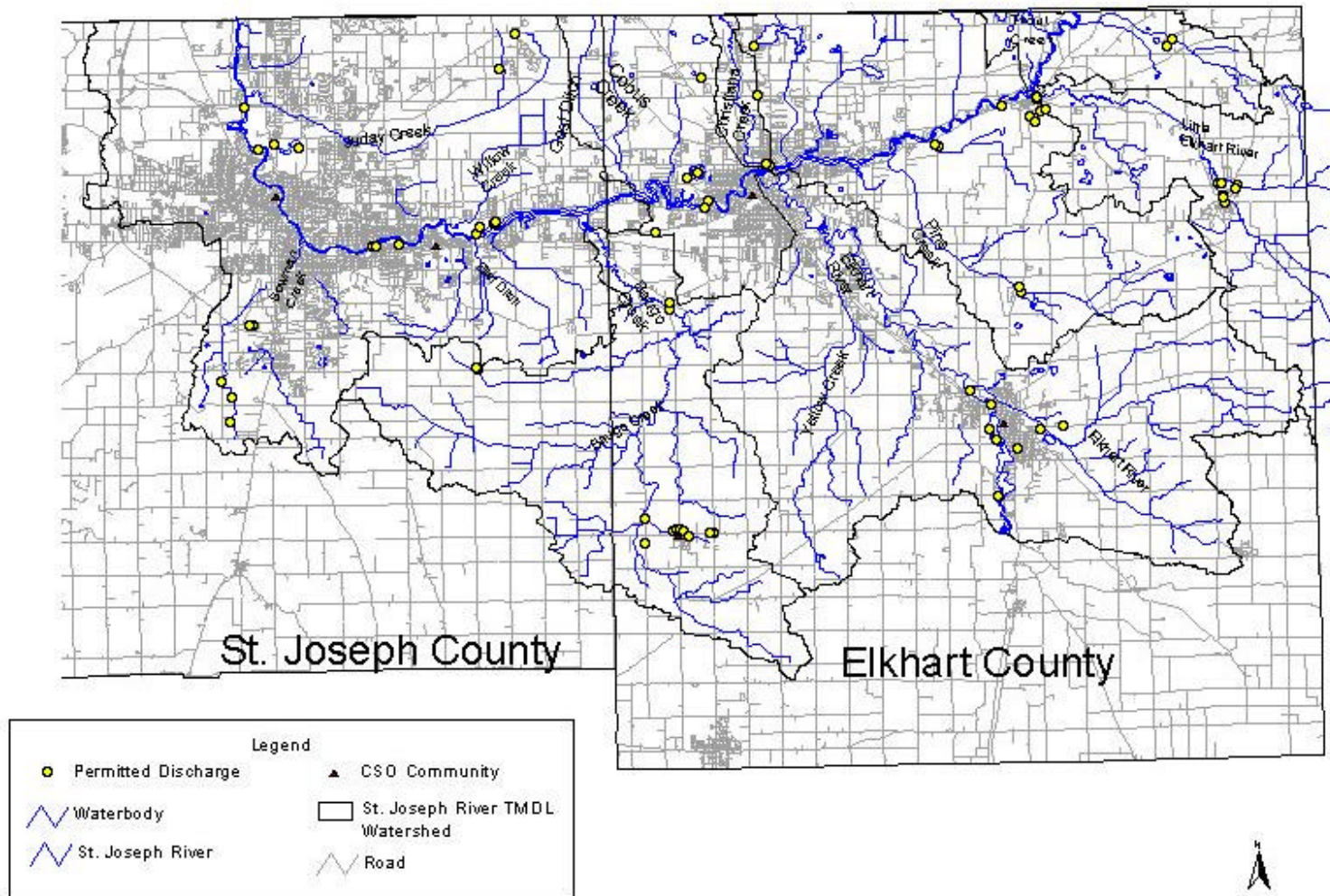
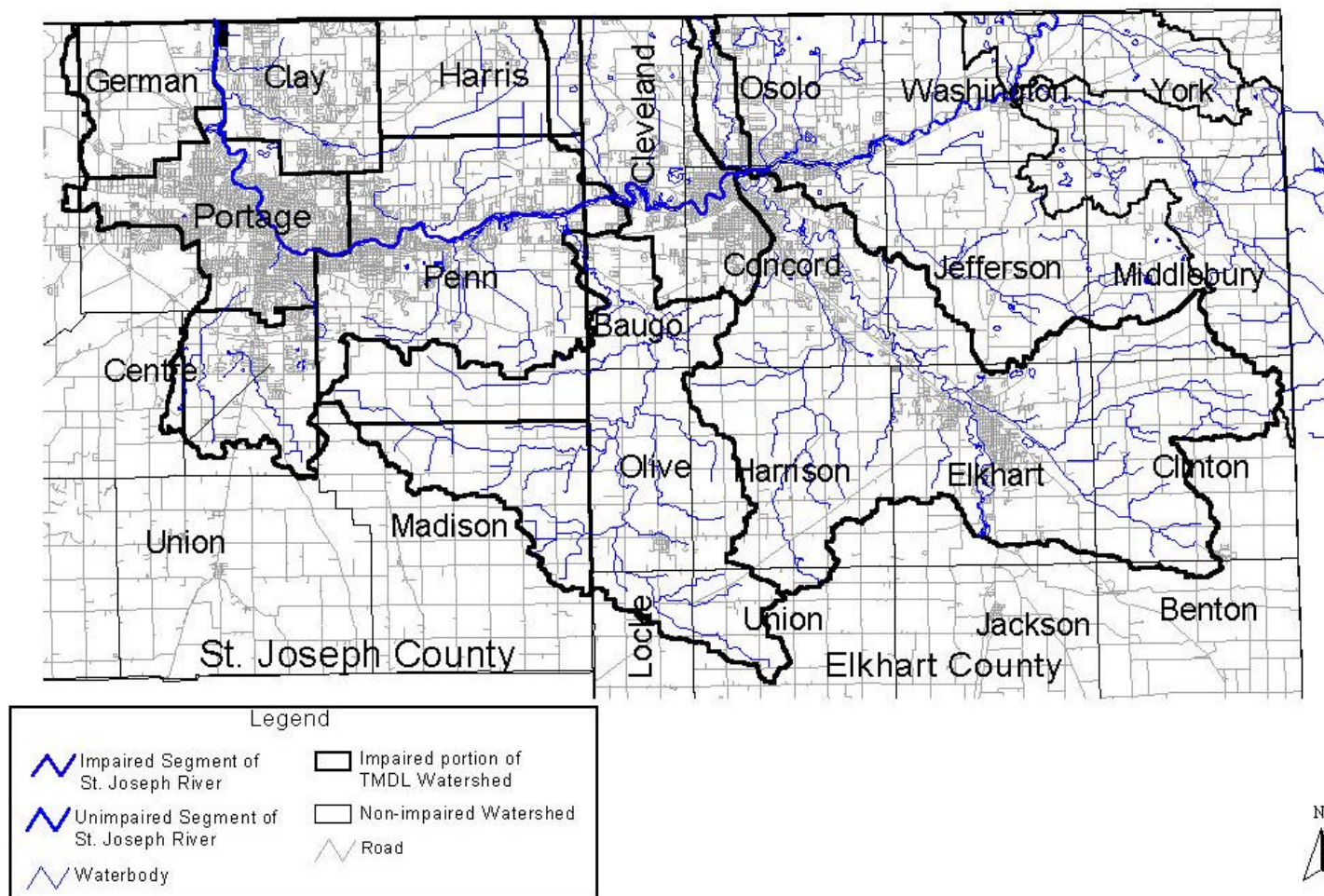


Figure 7: Townships in the St. Joseph River TMDL Watershed



Attachment A

St. Joseph River Watershed *E. coli* Data

Attachment B

Water Quality Duration Curves for the St. Joseph River TMDL

Attachment C

Load Duration Curves for the St. Joseph River TMDL

